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IS 4910 (Part 3) : 1989
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Indian Standard

TYRE YARNS, CORDS AND TYRE CORD WARPSHEETS MADE FROM MAN-MADE FIBRES — METHODS OF TEST

PART 3 LOAD AND ELONGATION CHARACTERISTICS

(First Revision)

भारतीय मानक

कृत्रिम रेशों से निर्मित टायर सूत, डोरी और टायर डोरी ताना-चद्दरों की परीक्षण पद्धतियाँ

भार 3 भार और दीर्घीकरण लक्षण

(पहला पुनरीक्षण)

UDC 677·072·6 : 629·11·012·533·1 : 677·017·422·2

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

January 1990 **Price Group 2**

Physical Methods of Test Sectional Committee, TDC 1

FOREWORD

This Indian Standard (Part 3) (First Revision) was adopted by the Bureau of Indian Standards on 7 June 1989, after the draft finalized by the Physical Methods of Test Sectional Committee had been approved by the Textile Division Council.

This standard, which was first published in 1968 (as Part II), has been revised to incorporate changes on the basis of experience gained during its use.

In the preparation of this standard, due weightage has been given to the testing practices followed in the country in this field.

This standard (Part 3) forms a part of the series of standards under the title 'Methods of test for tyre yarns, cords and tyre cord warpsheets made from man-made fibres'. The other parts under the series are :

IS 4910 (Part 1) : 1989 Definition of terms
IS 4910 (Part 2) : 1989 Linear density
IS 4910 (Part 4) : 1989 Dip pick-up
IS 4910 (Part 5) : 1989 Head shrinkage and heat shrinkage force
IS 4910 (Part 6) : 1989 Wet contraction and wet contractile force
IS 4910 (Part 7) : 1989 Heat degradation
IS 4910 (Part 8) : 1989 Thickness
IS 4910 (Part 9) : 1989 Sampling for tyre yarns, cords and tyre fabrics made from rayon
IS 4910 (Part 10) : 1989 Creep
IS 4910 (Part 11) : 1989 Commercial mass
IS 4910 (Part 12) : 1989 Sampling for tyre yarns, cords and tyre cord fabrics made from polyamide
IS 4910 (Part 13) : 1989 Static Adhesion of textile tyre cord to vulcanized rubber

In reporting the results of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960. 'Rules for rounding off numerical values (*revised*).'

Indian Standard

TYRE YARNS, CORDS AND TYRE CORD WARPSHEETS MADE FROM MAN-MADE FIBRES — METHODS OF TEST

PART 3 LOAD AND ELONGATION CHARACTERISTICS

(First Revision)

1 SCOPE

1.1 This standard (Part 3) prescribes a method for determination of breaking load, elongation at break, load at specified elongation, elongation at specified load and tenacity of man-made fibre tyre yarns and cords taken from cheeses, cones, bobbins, spools, hanks, or tyre-cord warpsheets.

2 SAMPLING

2.1 Sample for the lot shall be drawn so as to be representative of the lot. Sample drawn in accordance with the relevant material specification or as agreed to between the buyer and the seller shall be held to be representative of the lot.

3 CONDITIONING OF TEST SPECIMENS

3.1 Unless otherwise agreed to between the buyer and the seller, the test sample shall be conditioned to a state of moisture equilibrium from the dry side in the standard atmosphere at 65 ± 2 percent relative humidity and 27 ± 2°C temperature. A standard temperature of 20 ± 2°C may also be used provided it is declared in the test report.

NOTE — When a test sample under zero tension has been left in such a way as to expose, as far as possible, all portions of it to the standard atmosphere for 24 hours, the test sample shall be deemed to have reached a state of moisture equilibrium.

3.2 For testing of oven-dry specimens, dry the sample to constant mass by placing it in a drying oven maintained at 105 ± 3°C and fed with air from standard atmosphere.

NOTE — Normally, complete drying of the sample is achieved in 2 hours.

4 ATMOSPHERIC CONDITIONS FOR TESTING

4.1 The test shall be carried out in a standard atmosphere (*see* **3.1**).

5 APPARATUS

5.1 Testing Machine

A single strand tensile strength testing machine working on one of the following principles shall be used.

a) Constant-rate-of-load (CRL)

b) Constant-rate-of-traverse (CRT), or

c) Constant-rate-of-extension (CRE).

The specimens shall break within 20 ± 2 seconds in case of constant-rate-of-load and constant-rate-of-extension machines. In case of constant-rate-of-traverse machine, the rate of traverse shall be 300 ± 15 mm/minute and the load range of the machine shall be such that the observed values would be between 10 and 90 percent of the full scale load. The permissible error in the machine at any point in this range shall not exceed ±1 percent. The machine shall be provided with the following:

a) Two clamps with the following provisions to grip the specimen:

   1) Each clamp of the machine shall be bollard type in which the yarn is gripped between the plain-faced jaws and then makes a half-turn round a cylindrical extension of one of the jaws before passing on to the other similar clamp. The cylindrical friction surface shall be between 10 to 20 mm in diameter. An outline of the above type of clamp is shown in Fig. 1. The length of the specimen between points *A* and *A'* is the test length.

   2) Each clamp shall be provided with a mechanical or pneumatic device so constructed that through its means, a specimen can be secured firmly between the jaws of the clamps so that it does

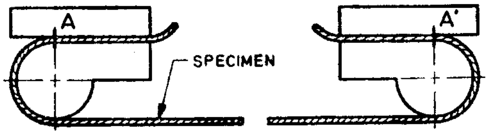

FIG. 1 RECOMMENDED GRIPPING CLAMPS

not slip during the test. Also the edge of the surface of each jaws shall be such that it would not cut or damage the specimen during testing.

NOTE — For cheking suitability of chosenclamps for testing, samples of various gauge length (namely, 200, 400, 600, 800, 1000 mm) may be stretched to break and elongation at break plotted against the gauge length to obtain graph as shown in Fig. 2.

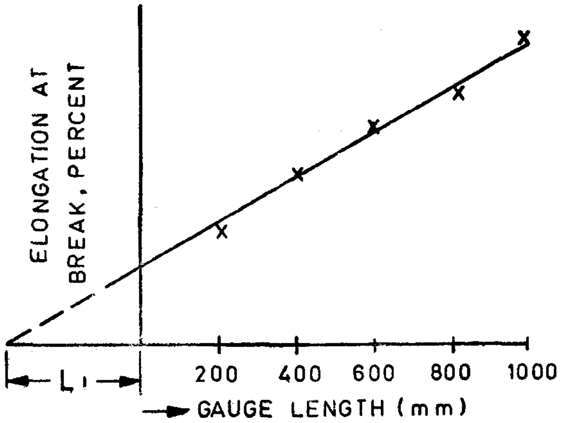

FIG. 2 SELECTION OF SUITABLE CLAMPS

If L_i exceeds 10 percent of gauge length to be used, the clamps or clamping surfaces are not suitable and may only be used if the parties agree.

b) Means for applying standard pre-tension of 4·4 ± 0·9 mN/tex to the specimen when clamped (the tension device may be dead-weight, a spring, or an air-actuated mechanism).

c) Means for adjusting the distance between the clamps.

d) A scale or dial or autographic chart recorder graduated so as to give load, elongation at pre-determined load/break and load at specified percentage elongation.

5.2 Drying Oven

Provided with forced ventilation and capable of maintaining a temperature of 105 ± 3°C.

6 PROCEDURE

6.1 Test on Conditioned Specimens

6.1.1 Set the clamps of the testing machine so that the distance between the clamps is 250 ± 2 mm, 500 ± 2 mm, or as agreed to between the buyer and the seller. With the help of preliminary specimens, set the machine so that the specimen breaks within 20 ± 2 seconds in case of constant-rate-of-load and constant-rate-of-extension machine and in case the machine is of constant-rate-of-traverse type, set it at a rate of traverse of 300 ± 15 mm/minute. Take the yarn or cord from the conditioned sample and discard a first few metres of yarn or cord. Fix one end in the jaws of one clamp in such a way that the twist does not change. Apply the required pre-tension from the free end and secure it in the jaws of the other clamp.

6.1.2 Operate the machine and carry the test to rupture and record the breaking load, elongation at pre-determined load as required, elongation at break and load at specified percentage elongation (LASE) from the load elongation curve of the autographic chart recorder provided.

NOTES

1 If a specimen under test breaks within 1 cm of the point of contact of either jaw, or there is slippage in the jaw, the result should be recorded but not included in the final result. If such breaks exceed 10 percent of the number of specimens tested, overhaul the jaws of the clamps. If necessary, test the specimens with suitable snubbing device, namely, soft leather or paper, though under these conditions, observed values for elongation will not be comparable with those obtained with regular clamps. Give specimens of very low twist multifilament yarns of which more than 10 percent of the specimens breaks in the clamps, a twist of 120 ± 10 turns/metre prior to test for breaking load.

2 When using automated testers in the normal manner, it is usually impossible to cancel the results of defaulted tests. Such results may have a large influence on the final results. To avoid these errors, it is necessary to watch the running test and to correct the test results for any jaw breaks or other defaulted tests. Where the results are read from a digital system and not from the recording chart, the elongation at break is determined at the instant when the measured force has fallen by a predetermined percentage of the full scale value after having passed the minimum value and there will be a systematic deviation in the recorded elongation. The predetermined percentage must be agreed upon between the parties and included in the test report.

If yarn is tested directly from the package in automatic testers, it can result in a different relaxation state of the yarn and the test result may differ from that of a relaxed state.

6.1.3 Open both the clamps and remove the broken specimen. Test another test specimen in a similar manner, discarding at random several metres of yarn between the two successive tests. Perform minimum 20 tests or more as agreed to between the buyer and the seller. In case of sample of yarn or cord from fabrics, a minimum of 20 tests or more as agreed to between the buyer and the seller shall be carried out. The selection of test specimens shall be as agreed to between the buyer and the seller.

6.2 Test on Oven Dry Specimens

6.2.1 Mount the thread without disturbing the twist on a support which would allow the yarn or cord to contract during drying. Put the material in drying oven maintained at 105 ± 3°C (*see* **3.2**). Immediately after drying, mount the yarn or cord, under pre-tension, in the clamps of the tensile testing machine kept in the standard atmosphere near the oven, care should be taken to see that no change in twist occurs while the specimen is being removed from the oven to the testing machine and clamped. Carry the test to rupture as specified in **6.1.1** and **6.1.2**.

6.2.2 Maintain the interval from the commencement of loading to the moment of rupture as 20 ± 2 seconds and the interval between the moment at which the test specimen leaves the oven and the moment at which it breaks as 30 ± 2 seconds.

6.2.3 Discard unused portion of yarn or cord outside the oven before mounting a fresh specimen. Perform a minimum of 20 tests or more as agreed to between the buyer and the seller.

7 CALCULATIONS

7.1 Breaking Load

Calculate the mean breaking load in newtons from all the observed values and the coefficient of variation.

7.2 Elongation

Calculate the mean elongation at pre-determined load as required and at break in percent from all the observed values.

7.3 Load at Specified Percentage Elongation

Calculate the mean load at specified percentage elongation in newtons as required.

7.4 Tenacity

Calculate the tenacity by the following formula :

Tenacity, in eN/tex

$$= \frac{\text{Man breaking load in newtons} \times 100}{\text{Mean linear density in tex}}$$

NOTE — The linear density of yarn or cord shall be determined from the same package in accordance with Part 2 of this standard.

8 REPORT

8.1 The test report shall include the following:

a) Description of the material tested;

b) Name of the instrument and capacity;

c) Mean time for break or rate-of-traverse;

d) The type of test (conditioned or oven dry);

e) Specimen length:

f) Number of tests performed;

g) Mean breaking load and coefficient of variation, if required;

h) Mean elongation at a predetermined load, if required ;

j) Mean elongation at break;

k) Mean load at specified percentage elongation (LASE), if required;

m) Mean tenacity; and

n) Temperature used for conditioning, that is, 27 ± 2°C or 20 ± 2°C.

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